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Core-M has undertaken to design, develop and produce proof of concept models of control and data acquisition system for the LSTAT sled. The architecture for such a system is based on Core-M's unique modular electronic units that are individually programmable for any desired application. Each module has its own microcontroller and memory buffer area to assure real time acquisition and processing of the data collected. The units communicate with each other through I2C protocol, which requires only two wires. This unique approach makes it possible to realize low weight, low power, easy to implement system for LSTAT sled project.

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Principal Investigator's Signature   3/23/98
Date

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1.0 INTRODUCTION

On October 28, 1996 Core-M received a contract from the US Army Department of Medical Research to design, develop and produce proof of concept models of an LSTAT electronic modular control system which is lightweight and has low energy requirements. Said control system is to be based upon Core-M's previously developed hardware/firmware architecture. Under this system the physiological and environmental parameters on LSTAT sled are collected under real time clock calendar where this critical information is relayed to the user through a rugged LCD display. Next to display is a keypad provided for convenient user input. All data collection and information distribution is accomplished through I2C, which requires only two wires. The data acquisition is accomplished by individual units, which have their own micro controllers and memory buffer areas. Core-M's this approach in gathering data and distributing command assures the most reliable, lightweight, low-powered configuration.

2.0 WORK PROGRESS

During the end of 1996, the first quarter of 1997 and the first quarter of 1998 the LSTAT design team has finalized the design and prototyping of all the core modules that are essential to the system. These are "High Speed I2C" communications module, "Medium Speed I2C" communications module, "High Capacity Electronic Mass Storage" module, and "Precision Real Time Clock Calendar" module. The design team also finalized the design of "User I/O" module with LCD display and keypad.

The following is a summary of the status of each of the above listed modules:

2.1 High Speed I2C

The High Speed I2C communications module is responsible for moving command and data to other modules at the rate of 1.0 MHz and higher. This module converts wide ranges of communications protocols to I2C and is used as an interface between other units such as the ones that have only RS-232 communications capability. The modules have their own micro controllers and memory storage sections that buffer the incoming data. The design of this module is finalized. The prototype is implemented and the core software algorithms are created for high-speed data transfers.

2.2 Medium Speed I2C

The Medium Speed I2C communications module establishes command and data transfers between sensory modules and the master control unit. Similar to the High-Speed communications module, this module converts different communications protocols to I2C and is used as an interface between other units. The modules have their own micro controllers and memory storage sections that buffer the incoming data. The speed of this module is 400 kHz. The design of this module is finalized. The prototype is implemented and the core software algorithms are created.

2.3 High Capacity Mass Storage Module

The Mass Storage module stores the entire system status and data in 40 Mbytes rewritable flash memory banks. The module communicates directly with the master control unit on parallel data bus. The design of this module is finalized. The prototype is implemented with a smaller capacity version and the core software algorithms are created.

2.4 Real Time Clock

The Precision Real Time Clock Calendar and the Real Time Clock Calendar modules are designed and implemented as an integral part of communications modules. This method assures the best timing precision on the real time events as they are gathered and buffered independent of the master control unit by the communications modules. These units are responsible for synchronizing and tracking the real time clock and calendar information on the events and data that is stored in the Mass Storage module.

2.5 User I/O

The User I/O module establishes the user interface with the whole system. It contains a custom LCD display with touch screen capability, and membrane key switches for information display and user input. The design of custom LCD together with its electronics and membrane key switch is finalized and submitted to the LCD vendor for manufacturing of prototypes. However, at this juncture due to the complexity of the display information segments, the long lead times for the manufacturing of prototype units and exorbitant NRE fees (non recurring engineering fees) has forced us to redesign the user I/O employing an off the shelf high performance LCD module. Said redesign has been completed.

3.0 CONCLUSION

In addition to the completed tasks to date, the design/development team has commenced work on the following tasks, which are yet to be completed:

3.1 Selection and implementation of new micro controller for use in the master control unit. Among various new generation micro controllers, the design team has evaluated a wide range of products. These include Philips 8051 XA, Intel 80251, Intel 80151, Intel 80296, Motorola 68HC12, and Motorola 68HC16. Motorola 68HC16 is selected as the micro controller for the master control unit. At this juncture, the design team is yet to fully deploy/implement its micro controller selection.

3.2 Interface with other on board devices: no significant progress has been made to date on this front with the exception of protocol format definition. Design and implementation of environmental sensory modules the sensory input module has been developed, however no sensory integration has been fully completed at this juncture.

3.3 Prototype production of the various modules is yet to be realized.

3.4 The analog modules that interface between physiological sensors and the system are ready. The interface and control of these units is to be realized.

3.5 Prototyping and software for the user I/O module with LCD and keypad needs to be done.

3.6 Mechanical enclosures and cabling connections and harnesses has to be worked out.

3.7 System integration and validation: said effort has yet to be tackled.